COLORADO
Department of Public Health & Environment

Air Pollution Control Division
Stationary Sources Program

June 16, 2016

Colorado Engine Testing Program: Summary of Phase 1 Results

Project Objectives

1. Conduct at least 30 tests to quantify NOx and CO emission rates in an "as-found" condition.

2. Provide results of all testing to operators as a compliance assistance measure.

Actions:

Colorado Air Pollution Control Division ("Division") personnel have completed Phase 1 of the Colorado Engine Testing Program. Emissions tests were conducted from November 2014 through April 2015 throughout Colorado at 10 facilities, operated by 10 different operators. Testing was conducted on a total of 32 natural gas fired engines, each nameplate rated at greater than 500 horsepower (HP).

During the week prior to the planned testing, affected operators were contacted to arrange for the Division to have access to facilities in the area. Specific meeting locations were determined the day before each planned test day. On the day of the test, APCD personnel met with operators, identified the facility selected for testing, then proceeded to the facility to test the engines. The project goal was to conduct emission tests on at least 30 engines.

Emission measurements of nitrogen oxides (NOx) and carbon monoxide (CO) were conducted on 32 natural gas fired engines at 10 facilities. Testing was conducted on four-stroke rich burn (4SRB) and four-stroke lean burn (4SLB) engines.

The following table summarizes the results by engine type.

	4SRB >500Hp	4SLB >500 HP	All Engines Tested
# Tested	9	23	32
# Failed	4	5	9
%Failed	44%	22%	28%
# Evidence of Tuning	3	6	9
% Failed or Tuned	78%	48%	56%

Findings:

With the limited number of tests, the statistical significance of the acquired data makes it difficult to draw firm conclusions with a great degree of certainty. However, the following observations are noted:

1. The study showed that a significant percentage of engines were not operating within their permitted level when tested independently by the Division. Without the facilities conducting more frequent engine monitoring the resulting excess emissions may occur for substantial periods of time.

2. Compliance assistance was successfully achieved for all engines that were found to be operating out of compliance. All operators were informed of test result and action was taken to return to compliance for all engines that were found to be out of compliance.

3. Measuring pre-catalyst temperature and pressure drop across the catalyst alone are not sufficient to ensure that ongoing engine emissions are in compliance with permitted emission limits. Frequent exhaust sampling and engine adjustment is likely necessary to ensure compliance.

4. The notification procedures used in Phase 1 were not adequate to ensure that measured emission rates were representative of "as-found" conditions. Evidence of engine tuning was present at 4 of the 10 facilities at which testing were conducted, which potentially biased the results of 9 of the 32 engines tested.

Next Steps

1. The Division plans to execute a Phase II of the engine testing program.

2. Minor modifications to the operator notification process will be made as to allow the Division an opportunity to see engines in more representative "as found" scenarios.